

Embedded Optical Sensors for Thermal Barrier Coatings

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The objective of this program is to develop a class of optical sensing methods for monitoring thermal barrier coatings based on the luminescence properties of dopants incorporated within the crystal structure of the thermal barrier coating itself. The program is focused on commercial thermal barrier coating materials, such as yttria-stabilized zirconia and gadolinium zirconate. In the first part of the program, in which we are presently engaged, the primary emphasis is on the selection of candidate luminescent dopants that are phase compatible with the coating materials, that can be incorporated without destabilizing the coating and yet exhibit high luminescence efficiency. In later stages, sensors will be fabricated and then demonstrated in both air and in a combustion environment.

Although the program has only recently begun we have been successful in doping coating materials with several rare-earth dopants and have begun characterizing their room temperature luminescence as a function of concentration. This characterization stage will continue in the coming months and the thermal stability assessed in thermal cycling tests. Concurrently, the fabrication of simple sensor structures are being attempted with the objective of demonstrating the first coating sensor deposited by electron beam deposition by the end of the year.